Simpson

INSTRUMENTS THAT STAY ACCURATE

6-C-63

# OPERATOR'S MANUAL

**WARNING**

For safe usage, it is essential that the operator read this manual carefully before using the instrument for any measurements.

**MODEL 269-3**
**VOLT-OHM-MICROAMMETER**


SIMPSON ELECTRIC COMPANY

853 Dundee Ave., Elgin, Illinois 60120
Area Code 312, Telephone 697-2260
In Canada, Bach-Simpson, Ltd., London, Ontario

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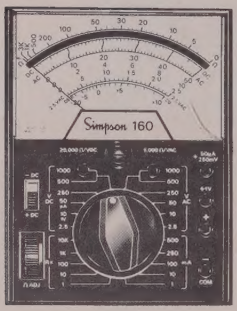


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**with Full-Size VOM Features**

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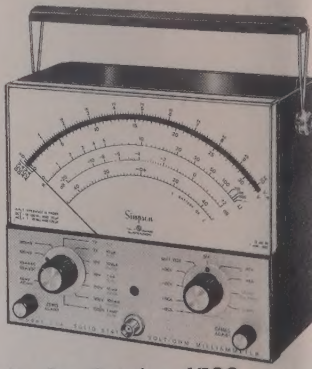
- 5 Resistance Ranges . . . Plus a 0-250 DC Millivolt Range



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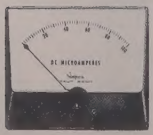

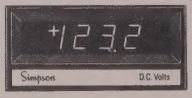

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# OPERATOR'S MANUAL

## MODEL 269-3
## VOLT-OHM-MICROAMMETER

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**Area Code 312, Telephone 697-2260**
**In Canada, Bach-Simpson, Ltd., London, Ontario**

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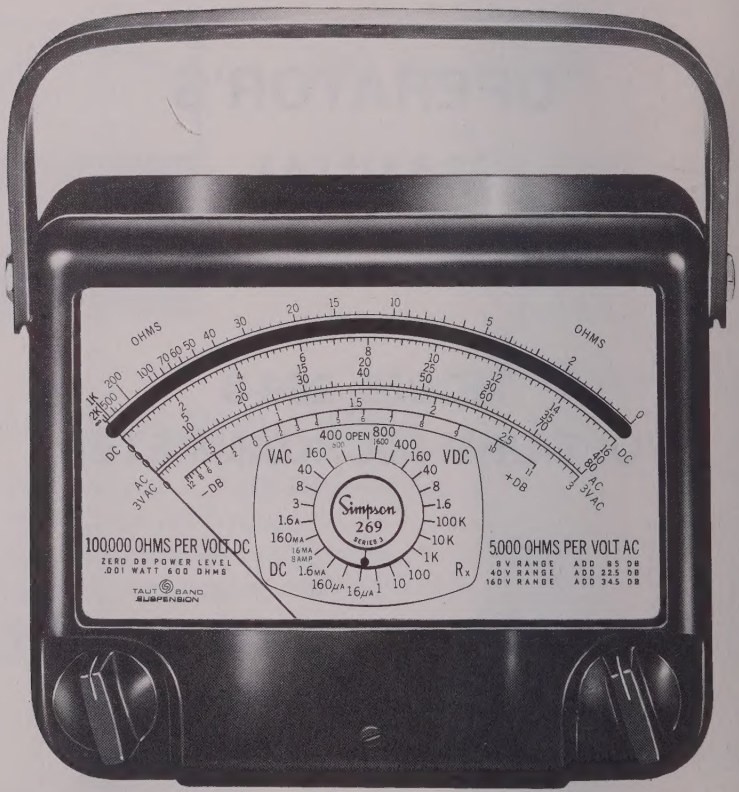


**Figure 1-1. Simpson Model 269-3 Volt-Ohm-Microammeter**

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**WARNING**

**The Simpson Model 269-3 is designed to prevent accidental shock to operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely prior to making any measurements. Failure to follow directions can result in a serious or fatal accident.**

**SHOCK HAZARD:** As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson Model 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with a Simpson 0-500 DC microammeter and use this as the measuring instrument.

# SECTION I

# INTRODUCTION

## 1.1 GENERAL

**1.1.1** The Simpson Volt-Ohm-Microammeter Model 269-3 (hereinafter referred to as Model 269-3, or simply the Instrument), is a rugged, accurate, compact, easy-to-operate tester which can be used for measuring electrical characteristics of circuits and circuit components. It indicates DC voltages, AC voltages, direct current, resistances and decibels.

**1.1.2** The Model 269-3 has a 6" mirrored dial for optimum readability and resolution. To complement the circuit accuracy, this tester contains the Simpson self-shielding taut-band movement. Taut-band suspension provides a high degree of repeatability.

**1.1.3** To protect those circuits most susceptible to overload, the tester is fused. Whenever the ohmmeter ranges are misused or the milliammeter ranges are overloaded, the fuse will blow, thus protecting the circuits from damage. The fast-blowing fuse is rated at 1.5 amperes, and is soldered onto the printed circuit board.

**1.1.4** The tester is housed in a sturdy, black phenolic case, molded with reinforced walls for maximum durability. All the component parts comprising the tester are assembled to the front panel. The entire tester slips into the case as one integral unit.

**1.1.5** Common to modern engineering practices, most of the components are mounted on a printed circuit board. This simplifies assembly, simplifies maintenance and extends the useful life of the tester.

**1.1.6** The handle may be used to position the tester to a convenient slope for easy top viewing. The tester may be used in either vertical and horizontal position.

## 1.2 ACCESSORIES AND SUPPLIES

Each tester is supplied with an operator's manual, a pair of test leads with removable alligator clips, and a 4000 VDC probe extension. The red and black test leads have probe tips which are threaded near the base. The alligator clips may be screwed on or off the test leads to provide either a probe or a clip. The 4000 VDC probe extension is intended to screw on over the tip of the red test lead, for measuring high positive voltage, or over the tip of the black test lead, for measuring high negative voltage.

## 1.3 TECHNICAL DATA

Table 1-1 lists the technical specifications for the Model 269-3.

**Table 1-1. Technical Data**

**1. DC Voltage (100,000 ohms per volt)**

| Range | Resistance | Range | Resistance | Range | Resistance |
|---|---|---|---|---|---|
| 0-0.8V | 80 KΩ | 0-40V | 4 MΩ | 0-800V | 80 MΩ |
| 0-1.6V | 160 KΩ | 0-160V | 16 MΩ | 1-1600V | 160 MΩ |
| 0-8V | 800 KΩ | 0-400V | 40 MΩ | 0-4000V | 400 MΩ |

Accuracy:
DC Volts up to 1600V ±1½% of full scale
DC Volts 0-4000
(with external multiplier ±3½% of full scale

**2. Resistance**

| Range | Scale | Center Scale | Open Circuit Voltage | Short Circuit Current |
|---|---|---|---|---|
| RX1 | 0-2000Ω | (12Ω) | 1.5V | 125 mA |
| RX10 | 0-20,000Ω | (120Ω) | 1.5V | 12.5 mA |
| RX100 | 0-200,000Ω | (1200Ω) | 1.5V | 1.25 mA |
| RX1K | 0-2 MΩ | (12,000Ω) | 1.5V | 125 μA |
| RX10K | 0-20 MΩ | (120,000Ω) | 22.5V | 187 μA |
| RX100K | 0-200 MΩ | (1.2 MΩ) | 22.5V | 18.7 μA |

Accuracy: ±2° of scale arc

**3. AC Voltage (5000 ohms per volt):**

| Range | Resistance |
|---|---|
| 0-3V | 15 KΩ |
| 0-8V | 40 KΩ |
| 0-40V | 200 KΩ |
| 0-160V | 800 KΩ |
| 0-400V | 2 MΩ |
| 0-800V | 4 MΩ |

Accuracy: ±2½% of full scale

**4. Rated circuit-to-ground voltage**

*Max. 1600V

*Per A.N.S.I. C39.5, Apr. 1974. "The specified voltage with respect to ground which may be safely and continuously applied to the circuits of an Instrument".

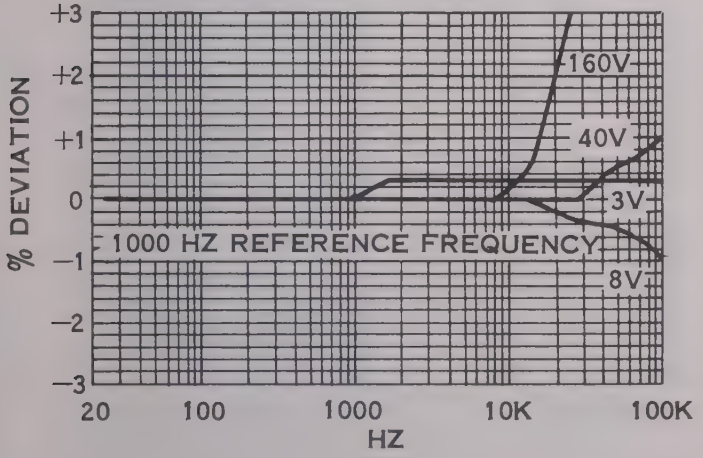


**Figure 1-2. Frequency Chart**

**5. DC Current (215 mV drop, Max)**

Ranges

1 to 16 $\mu$A
0 to 160 $\mu$A
0 to 1.6 mA
0 to 16 mA
0 to 160 mA
0 to 1.6 mA
0 to 1.6 A
0 to 8 A

Accuracy: ±1½% of full scale

**6. Volume level in decibels (dB)**

0 dB reference is 1 mW into 600Ω (0.775V rms)
Interpret readings on the dB scale as follows:

| VAC Range Setting | Add to Scale Reading, dB | Calibrated dB span |
|---|---|---|
| 3V | 0 | −12 to +11 dB |
| 8V | 8.5 | −3.5 to +19.5 dB |
| 40V | 22.5 | +10.5 to +33.5 dB |
| 160V | 34.5 | +22.5 to +45.5 dB |

Accuracy: −dB at the zero dB point

**7. Power Requirement:**

Batteries: (1) No. 2 Size D flashlight battery NEDA 13C
(1) 22.5 volt battery NEDA 215

**8. Weight:** 3-¼ pounds (1.48 kg)

**9. Dimensions:** 6" high, 7-¼" wide, 3-¼" deep (152.4 mm x 181.15 mm x 82.05 mm)

# SECTION II

# INSTALLATION

## 2.1 UNPACKING AND INSPECTION

**2.1.1** Examine the shipping carton prior to unpacking for signs of damage. If there is none, unpack and inspect the Instrument for possible damage in shipment. Check the electrical performance as soon as possible. If damage is noted, notify the carrier and supplier before using the Instrument. Also check that all items are included (Table 7-1).

**2.1.2** Save the shipping carton and packing materials for future storing or shipping of the Instrument.

## 2.2 POWER SOURCE REQUIREMENTS

**2.2.1** The Model 269-3 is designed to be operated from a No. 2 Size D flashlight battery NEDA 13C and from a 22.5-volt battery NEDA 215 (not furnished with the Instrument). Refer to Table 1.1.

# SECTION III

# CONTROLS, CONNECTORS, AND INDICATORS

## 3.1 GENERAL

All operating and adjustment controls, connectors,and indicators are described in Table 3-1. Become familiar with each item prior to operating the Instrument for the first time.

## 3.2 FRONT AND SIDE PANEL DESCRIPTIONS

Table 3-1 lists the front panel controls, connectors and indicators. See Figure 3-1 for identification.

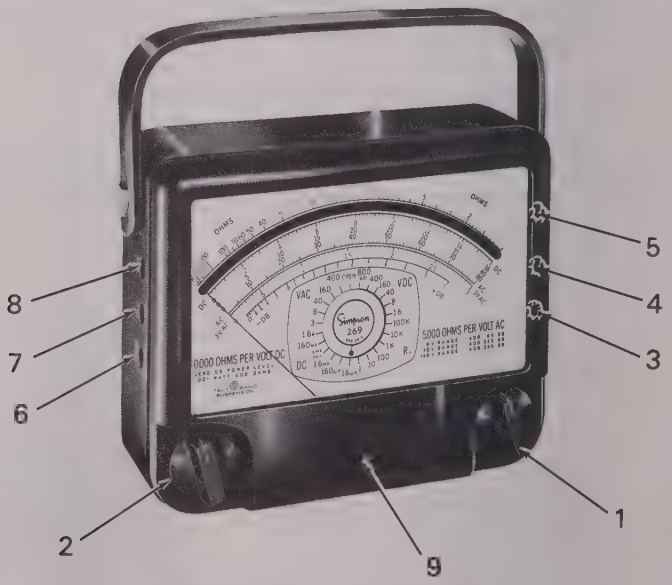


**Figure 3-1. Front and Side Panels**

Table 3-1. Front and Side Panel Description

**1. FUNCTION AND RANGE SWITCH**

| Switch Position | Description |
|---|---|
| 16 $\mu$A to 1.6 A | Direct current readings (215 millivolt drop maximum) |
| 3 to 800 VAC | AC Voltage readings (5000Ω/volt) |
| 1.6 to 400 VDC | DC Voltage readings (100,000Ω/volt) |
| 1 to 100 KΩ | Multiplying Factor for DC Resistance readings |

**2. ZERO OHMS CONTROL**

| | |
|---|---|
| Adjustable | Used to obtain a zero indication for the ohmmeter when the test leads are shorted together. |
| **3. COM. −jack** | This jack is used for all ranges and functions. |
| **4. +jack** | The + jack is used in conjunction with the COM. −jack for all ranges and functions except the +8 AMP, 800 VAC, 1600 VDC and 0.8 VDC ranges. |
| **5. +8 AMP jack** | The +8 AMP jack is used in conjunction with the COM. −jack for 0-8 AMP DC current measurements. |
| **6. .8 VDC jack** | Used to read voltages from 0 to 0.8 VDC. |
| **7. 1600 VDC jack** | The 1600 VDC jack is used to extend the 800 VDC range to 1600 VDC. |
| **8. 800 VAC jack** | The 800 VAC jack is used to extend the 0-400 VAC range to 800 VAC. |
| **9. Zero Adjust Screw** | Used to position meter pointer to mechanical zero (paragraph 4.4.2). |

# SECTION IV

# OPERATION

## 4.1 GENERAL

**WARNING**

**The Model 269-3 is designed to prevent accidental shock when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely prior to making any measurements. Failure to follow directions can result in a serious or fatal accident.**

This section of the manual contains all the information required to use and operate the Model 269-3 in a safe and proper manner. Special notes and instructions also have been provided for added user safety, and convenience.

## 4.2 SAFETY PRECAUTIONS

**4.2.1** The Model 269-3 is intended for use only by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury. Refer to SHOCK HAZARD definition on page iv.

**4.2.2** Do not work alone when making measurements where a shock hazard can exist. Notify a nearby person that you are making, or intend to make, such measurements.

**4.2.3** Remember that voltages might appear unexpectedly in defective equipment. An open bleeder resistor can result in a capacitor's retaining a dangerous charge. Discharge all capacitors in the circuit being measured *before* making connections or disconnections. The Instrument itself is well protected against electrical overload. However, the above precautions are wise even in the laboratory, and especially in field usage of the Instrument, where many strange or unknown safety hazards might prevail.

**4.2.4** Locate all voltage sources and current accessibility paths prior to making any measurement or connections.

**4.2.5** For your own safety, inspect the test leads for cracks, breaks or crazes in the insulation probes and connectors before each use. If any defects are found, destroy and replace the defective item(s) immediately.

**4.2.6** Do not make measurements in a circuit where corona is present. Corona can be identified by a pale-blue color emanating from sharp metal points in the circuit, or by a buzzing sound, or by the odor of ozone. In rare instances, such as around germicidal lamps, ozone might be generated as a normal function. Ordinarily, the presence of ozone indicates presence of high voltage, and probably an electrical malfunction. Aside from the aspect of shock hazard presence of corona often indicates ionization or leakage which tend to invalidate your measurements.

**4.2.7** Hands, shoes, floor and workbench must be dry. Avoid making measurements under humid, damp, or other environmental conditions that could exceed the ratings of the Instrument.

**4.2.8** For maximum safety, do not touch test leads, circuit, or Instrument while power is applied to the circuit being measured.

**4.2.9** Use extreme caution when making measurements in an rf circuit where a dangerous combination of voltages could be present, such as in a modulated rf amplifier.

**4.2.10** Do not use test leads of lesser safety than those originally furnished with the Instrument.

**4.2.11** If the pointer deflects to the left of the zero, the polarity is reversed. Turn off the power and reverse the test leads. Turn power on again and make the measurement.

## 4.3 PRELIMINARY NOTES AND CHECKS

Prior to operation of the Instrument, review and perform (where applicable) the following notes and checks. These steps also can be used as a general functional check.

## 4.4 INITIAL ADJUSTMENTS

### 4.4.1 Position the Tester

Place the tester in its operating position. It may be positioned vertically or horizontally, or the Adjust-A-Vue handle may be used as a support to position the tester at a convenient angle. The most accurate measurements will be obtained when the tester is positioned horizontally.

### 4.4.2 Zero Adjustment

Before making any measurements with the Instrument, check to see that the pointer indicates zero when the tester is in its operating position. If the pointer is off zero, turn the screw located below the center of the tester scale to correct the pointer position. Use a small screwdriver to turn this screw slowly, either clockwise or counter-clockwise, until the pointer is exactly over the zero mark at the left end of the scale. Then turn the zero adjuster slightly in the opposite direction to disengage the zeroing linkage.

## 4.5 DC VOLTAGE MEASUREMENTS, 0-.8 VOLT RANGE ONLY

a. Connect the black test lead into the COM. −jack and the red test lead into the .8 Volt DC jack.

b. Set the range switch to the 8 (.8) VDC position. When in doubt about value of voltage use the highest voltage range first. For higher ranges follow procedure in paragraph 4.6.

c. Connect the test lead clips or probes to the circuit to be measured and discharge any capacitors.

d. Read the voltage on the black arc marked DC which is second from the top of the dial.

e. For the .8 VDC range, read the 0-8 scale and divide the reading by 10.

## 4.6 DC VOLTAGE MEASUREMENTS, 0-800 VOLTS

a. The range switch has positions of 1.6 VDC, 8 VDC, 40 VDC, 160 VDC, 400 VDC, 800 VDC. When in doubt as to which range is needed, select the highest voltage range first to protect the tester. If the voltage is within a lower range, the switch then may be set for a lower range to obtain a more accurate reading.

b. Connect the black test lead into the COM, −jack and the red test lead into the + jack. If the pointer deflects to the left of the zero, the polarity is reversed. Turn off the power and reverse the test leads. Turn power on again and make the measurement.

c. Read the voltage on the black arc marked DC which is second from the top of the dial.

   1. For the 1.6 volt range, read the 0-160 scale and divide the reading by 100.
   2. For the 8, 40, 160 volt ranges, read the corresponding scale directly.
   3. For the 400 volt range, read the 0-40 scale and multiply the reading by 10.
   4. For the 800 volt range, read the 0-8 scale and multiply the reading by 100.

## 4.7 DC VOLTAGE MEASUREMENTS, 0-1600 VOLTS RANGE ONLY

a. Set the range switch at 1600 VDC (the same switch position as for the 800 VDC range).

b. Connect the black test lead in the COM. −jack, and the red test lead in the 1600 VDC jack.

c. Read the voltage, using the 0-160 scale on the black arc which is second from the top of the dial. Multiply the reading by 10.

## 4.8 DC VOLTAGE MEASUREMENTS, 0-400 VOLT RANGE ONLY

a. Rotate the Range Selector Switch so the range index dot reads 800 (or) 1600 VDC.

b. Plug the black test lead into the jack marked COM. −, and the red test lead into the jack marked 1600 VDC.

c. Screw the high voltage probe extension over the red test probe, if a high positive voltage is to be measured, or over the black test probe, if a high negative voltage is to be measured.

d. Read the voltage, using the 0-40 figures and the black arc marked "DC" which is second from the top of the dial.

e. Multiply the reading by 100.

## 4.9 AC VOLTAGE MEASUREMENTS, 0-3 TO 0-400 VOLT RANGES

**WARNING**

**Be extremely careful when working in high power type circuits with voltages greater than 250 volts and current capabilities in the amperes. Avoid holding the tester or leads while power is on in the circuit being measured.**

The Model 269-3 rectifier circuit responds to the fullwave average value of the AC voltage being applied. The tester dial is calibrated in terms of the RMS value of a sine wave.

a. Connect the black test lead to the COM. −jack, and the red test lead to the + jack.

b. Set the range switch to the VAC range desired.

c. For the 0-3 VAC range, read the value directly on the red arc marked 3 VAC ONLY.

d. For the 8 VAC, 40 VAC, and 160 VAC ranges, read the red arc marked AC, and use the corresponding black figures immediately above the arc.

e. For the 400 VAC range, read the red arc marked AC; use the 0-40 black figures and multiply the reading by 10.

## 4.10 AC VOLTAGE MEASUREMENTS, 0-800 VOLT RANGE ONLY

See warning in paragraph 4.9 above.

a. Set the range switch at 800 VAC (the same switch position as for the 400 VAC range).

b. Connect the black test lead to the COM. −jack, and the red test lead to the 800 VAC jack.

c. Read the voltage on the red arc marked AC; use the 0-8 black DC scale and multiply the reading by 100.

## 4.11 DECIBEL MEASUREMENTS

**4.11.1** For some applications, audio frequency voltages are measured or compared in terms of decibels. The decibel scale (dB), at the bottom of the dial, is numbered from −12 through 0 to +11. To measure decibels, proceed according to instructions for AC Voltages, and read the dB arc. The dB readings will be correct on an absolute scale if 0 dB is 0.001 watt (1 milliwatt) into 600 ohms (0.775 volt).

**4.11.2** To obtain dB values across 600 ohms:

a. For the 3 VAC range, read the dB arc directly.

b. For the 8, 40, and 160 volt ranges, add a fixed number as shown at the lower right corner of the dial to the reading on the dB arc. The accuracy of the correction factors is a function of the dB reading. In general, the error will not exceed ±1 dB. If better accuracy is required, calculate the dB from the indicated AC voltage.

**4.11.3** If the reference level is 0 dB = 0.006 watt (6 milliwatts) in 500 ohms, and the Model 269-3 readings are made across 500 ohms, subtract 7 dB from the reading to obtain the absolute decibel value.

## 4.12 RESISTANCE MEASUREMENTS

When DC resistances are measured, the batteries inside the case of the Model 269-3 furnish power to the measuring circuit. Correction for battery deterioration over long periods of time is provided by means of the ZERO OHMS control which is part of the ohmmeter circuit.

a. Each time the ohmmeter is to be used, set the ZERO OHMS control to provide full scale deflection of the pointer when the test probes are shorted together. Check and adjust each time a different range is used.

b. Set the range switch at the desired resistance range position.

c. Connect the black test lead to the COM. −jack, and the red test lead to the + jack.

d. Short circuit the test leads together to provide zero ohms resistance between them.

e. Observe the Instrument indication; note a reading 0 at the right end of the OHMS arc.

f. If the pointer does not read zero, rotate the ZERO OHMS knob at the lower left on the front panel until it does. If the pointer cannot be brought up to the 0 mark, one or more of the batteries have to be replaced (see Battery Replacement procedure, paragraph 6.7).

g. After the pointer is adjusted for zero, open-circuit the test leads and the ohmmeter is ready for use on that range.

h. Disconnect all power from the test circuit prior to measuring resistance with the ohmmeter. Do not apply any power before the measurements are completed and the test leads are disconnected.

i. Connect the test leads across the resistance to be measured. If there are different "forward" and "backward" resistances, such as in rectifiers and diodes, observe polarity. The red test lead is positive and the black test lead is negative. The measured resistance of diode rectifiers commonly will vary as measured on different ranges of the Instrument. For example, a crystal diode might indicate 80 ohms on the Rx1 range, and indicate 300 ohms on the Rx100 range. This is a normal diode characteristic.

j. Read the indication on the OHMS arc at the top of the dial. Note that this arc reads from right to left for increasing values of circuit resistance.

k. Multiply the reading by the multiplier factor indicated at the switch position; the result is the resistance value in ohms. K on the dial stands for times 1000.

## 4.13 DIRECT CURRENT MEASUREMENTS,0-16 μA TO 0-1.6 mA RANGES

**WARNING**

**For personal safety as well as that of the Instrument, do not exceed the rated circuit-to-ground voltage of the Instrument (Table 1-1). Connect current-measuring Instruments into the low potential side of the circuit whenever possible and always make secure connections (do not use test prods for current measurement). Review the SAFETY PRECAUTIONS in paragraph 4.2.**

a. Rotate the Range Selector Switch knob, in the lower right hand corner of the Instrument, to the highest DC current range. The DC current ranges are marked black in the area identified as DC. BEGIN WITH THE HIGHEST CURRENT RANGE, TO PROTECT THE TESTER. After obtaining the first reading,

rotate the range selector switch to a lower range for a more accurate reading, providing the current will be within the lower range.

b. Plug the black test lead into the jack marked COM.– and the red test lead into the jack marked +. Both of these jacks are located on the right hand side of the tester.

c. Disconnect any power sources, discharge any capacitors and open the circuit in which the current is to be measured. Connect the tester in series with the circuit. Connect the red test probe toward the positive side, and the black test probe toward the negative side of the opened circuit.

d. Turn on the power in the circuit which is to be measured.

e. Read the current value on the black arc marked DC which is the second from the top of the dial. If the pointer is deflected to the left of the scale, the test probes are reversed. Turn off the power, reverse the test probes, and turn the power back on.

**Table 4-1. Reading the Scales**

1. For the 16 $\mu$A range, read the figures 0-160 and divide by 10 for microamperes.
2. For the 160 $\mu$A range, read the figures 0-160 directly for microamperes.
3. For the 1.6 mA range, read the figures 0-160 and divide by 100 for milliamperes.
4. For the 16 mA range, read the figures 0-160 and divide by 10 for milliamperes.
5. For the 160 mA range, read the figures 0-160 directly for milliamperes.
6. For the 1.6 A range, read the figures 0-160 and divide by 100 for amperes.

## 4.14 DIRECT CURRENT MEASUREMENTS, 0-8 AMPERE RANGE ONLY

a. Rotate the Range Selector Switch knob, on the lower right hand corner of the tester, to place the range index dot at 8 AMP 16 mA.

b. Plug the black test lead into the jack marked COM.– on the right hand side of the tester. Plug the red test lead into the jack marked +8 AMPS on the right hand side of the tester.

c. Disconnect any power sources, discharge any capacitors and open the circuit in which the current is to be measured. Connect the tester in series with the circuit. Connect the red test probe toward the positive side, and the black test probe toward the negative side of the opened circuit.

NOTE: Connections to measure currents in this range must be made securely and have very low resistance. Never use test prods. Test clip resistance may cause significant measurement error in some cases. For maximum accuracy, connections should be attached by a secure clamping means or soldered connection and with a maximum of contact area.

d. Turn on the power in the circuit which is to be measured.

e. Read the current value on the black arc marked "DC" which is the second from the top of the dial. Read the figures 0-8 directly for amperes. If the pointer is deflected to the left of the scale, the test probes are reversed. Turn off the power, reverse the connections of the test probes, and turn the power on again.

## 4.15 DC HIGH VOLTAGE TESTING

**WARNING**

**Be extremely careful when working in high voltage circuits. Do not touch the tester or the test leads while power is on in the circuit being measured.**

**DC HIGH VOLTAGE TEST PROBES**
**(100,000 OHMS PER VOLT)**

| | |
|---|---|
| **Part No. 0119** | **16,000 VDC max.** |
| **Part No. 0157** | **30,000 VDC max.** |

**4.15.1** These probes extend the range of a 100,000 ohms-per-volt multimeter in a safe, convenient manner at nominal cost. Their primary purpose is to measure very high potentials in low power capability circuits such as television receiver or oscilloscope anode supplies. They (or the multimeter) are not intended for use to make measurements in high power capability circuits such as power substations, high power transmitter circuits or x-ray power supplies.

**4.15.2** The probe body is made of high temperature polystyrene to provide high dielectric strength and low surface leakage. It contains a high megohm value precision resistor.

**4.15.3** A shielded cable and internal probe shield are used to protect the operator from flash-over and ground any electro-static charge that might accumulate on the probe body.

**4.15.4** The internal shield and cable shield are connected to the ground return lead by a flexible copper braid between the two elbow connectors. A 48-inch ground return lead with an insulated clip completes the test lead set. No additional wires are needed.

**4.15.5** The probe is used with the tester in the 1.6-volt DC position. Thereby, the voltage drop across the tester is 1.6 volts; the balance of the voltage drop is across the series resistor inside the probe.

## 4.16 HIGH VOLTAGE MEASUREMENT

a. Set the range selector switch to the 1.6 VDC position.

b. To measure circuits with negative ground (chassis negative), connect the black elbow connector to the meter's COM. jack and the red connector to the + jack. To measure circuits with positive ground (chassis positive), connect the black elbow connector to the meter's + jack and the red connector to the COM. jack.

**WARNING**

**NEVER attempt to reverse polarity by switching the black test lead clip with the probe. The probe must always connect to the high voltage point. For maximum safety, turn off power to the circuit to be measured and discharge any capacitors before connecting or disconnecting test leads.**

c. Connect the black test lead clip to the low potential side (chassis) of the circuit to be measured making certain that the clip cannot fall off during measurements.

d. Turn the circuit power on and avoid contact with anything other than the probe while making the measurement.

e. Holding the probe body behind the guard ring, touch the probe tip to the high voltage point to be measured and note the reading on the multimeter. Determine voltage as follows;

16kV PROBE: Read the 0-160 VDC scale and multiply by 100.

30kV PROBE: Read the 0-40 VDC scale and multiply by 1000.

NOTE: Although the scale can be read to 40kV, the probe should not be used above the 300kV for which it was designed. Potentials exceeding 30kV defeat the margin of safety designed into the probe.

Instrument resistance is 20,000 ohms for all current ranges. The shunt resitance decreases for each succeeding higher current range.

# SECTION V

# THEORY OF OPERATION

## 5.1 GENERAL

The basic instrument movement of the Model 269-3 has a dc sensitivity of 10 microamperes.

## 5.2 DC CIRCUIT VOLTAGE MEASUREMENTS

Since the resistance of the meter movement is 20,000 ohms, and the voltage sensitivity is 200 millivolts for a full scale reading, the overall sensitivity as a voltmeter is 100,000 ohms/volt. For each higher range the Model 269-3 has multiplier resistors which are added in series with the basic DC voltage measuring circuit.

**5.2.1** To calculate the tester resistance, multiply 100,000 ohms by the number of volts for full scale deflection for each range. The tester resistance for each DC range is given in Table 1-1.

## 5.3 AC VOLTAGE MEASUREMENTS

**5.3.1** To measure AC voltages, a modified bridge rectifier within the Model 269-3 develops a DC voltage which is proportional to the full-wave average value of the measured AC voltage. The AC scale is calibrated in terms of the RMS value of a sine wave.

**5.3.2** The AC sensitivity is 5000 ohms/volt. For each higher range the Model 269-3 has precision resistors which are added in series with the basic AC voltage measuring circuit. To calculate the tester resistance, multiply 5000 ohms by the number of volts for full scale deflection for each range. The tester resistance for each AC range is given in Table 1-1.

## 5.4 DC CURRENT MEASUREMENTS

When the Model 269-3 is used to measure direct current, a shunt resistance is connected in parallel with the meter movement. The total circuit current is divided between the indicating instrument and the shunt, inversely proportional to their resistances. The shunt resistance decreases for each succeeding high current range.

## 5.5 RESISTANCE MEASUREMENTS

When the Model 269-3 is used to measure resistance, dry cell batteries within the tester furnish a known voltage through the tester circuit and through the measured resistance in series with the tester. With zero external resistance (test leads shorted together), the pointer is deflected to full scale; as resistance is added between the test leads, total current is decreased, and the pointer reads at a point less than full scale. The markings on the Model 269-3 show relative pointer deflection which results from adding the indicated amount of resistance in series between the test leads. For the Rx1, Rx10, Rx100 and Rx1000 ranges, one "D" size battery furnishes 1.5 volts DC for measuring resistances. For the Rx10K and Rx100K ranges, a 22.5-volt battery is used.

# SECTION VI

# MAINTENANCE

## 6.1 GENERAL

The Model 269-3 is a carefully designed and constructed Instrument employing high-quality components. By providing reasonable care, and following the instructions in this manual, the user can expect a long, useful service life from his Instrument.

## 6.2 WARRANTY

The Simpson Electric Company warranty policy is printed on the inside back cover of this manual. Read carefully prior to requesting a warranty repair.

NOTE: For assistance of any kind, including help with the Instrument under warranty, contact your nearest Simpson Authorized Service Center for instructions. These centers are listed on the last pages of the manual. If you wish to contact the factory directly, give full details of the difficulty and include the Instrument model number and date of purchase. Shipping instructions will be sent to you promptly. If an estimate of charges for non-warranty or other service work is required, a maximum charge estimate will be quoted. This charge will not be exceeded without your prior approval.

## 6.3 SHIPPING

**6.3.1** Pack the Instrument carefully and ship it prepaid to the proper destination. Insure the shipment.

## 6.4 PREVENTIVE MAINTENANCE

### 6.4.1 Daily Care:

a. Immediately clean all spilled materials from the Instrument and wipe dry.

**WARNING**

**Do not attempt to clean this Instrument with the test leads connected to a power source.**

b. Avoid allowing the batteries to discharge fully.

c. Whenever possible, avoid prolonged exposure or usage in areas which are subject to: temperature and humidity extremes, vibration or mechanical shock, dust or corrosive fumes, or strong electrical or magnetic fields.

### 6.4.2 Monthly Care:

Verify Instrument calibration by performing operational checks using stable, known sources. If the need for calibration is indicated, contact your nearest Simpson Authorized Service Center or the factory for a complete overall check, adjustment, and calibration.

### 6.4.3 Storage:

When the Instrument is not in use, store it in a location free from temperature extremes, dust and corrosive fumes, and mechanical vibration or shock. If storage is expected to exceed 30 days, remove the batteries.

## 6.5 TROUBLESHOOTING

**6.5.1** If the Instrument does not yield satisfactory results, follow this procedure, prior to attempting maintenance on the Instrument.

a. Review and comply with the Preliminary Notes and Checks, listed in paragraph 4.3.

b. Check that the function selector switch is positioned correctly for the parameter and range of value being measured and that the measurement is within the rating of the Instrument.

c. Insure that the environment in which the Instrument is being used is within the Instrument specifications.

d. Inspect the device being measured and the measurement test set-up to insure that proper shielding and grounding techniques have been used.

e. Consider whether the Instrument is significantly affecting the circuit being measured.

## 6.6 CASE REMOVAL

Whenever fuse replacement or other maintenance is required, the Instrument must be removed from its case. Proceed as follows:

a. Remove the test leads from their jacks.

b. Place the Instrument, face down, on a soft padded surface.

c. Completely unscrew the 4 recessed screws located at the 4 corners of the case.

d. Lift the case off the Instrument and set it aside. Maintenance now can be performed on the Instrument.

## 6.7 BATTERY REPLACEMENT

**6.7.1** Battery replacement is indicated whenever the Instrument cannot be adjusted to zero (0) ohms on the OHMS ranges. If the adjustment cannot be made on Rx1, Rx100, or Rx1K range, replace the 1.5V, D size cell. If the adjustment cannot be made on the Rx10K and Rx100K ranges, replace the 22.5V battery.

**6.7.2** The procedure for replacing batteries is as follows:

a. Remove the 3 screws holding the battery cover plate to the case.

b. To remove the D size battery, grasp at the positive end and pull directly up. To install new battery, insert the − end first, push against the − terminal spring clip, and then gently push the + side of the battery into place.

c. To remove the 22.5V battery, lift up the end which contacts the flat side of the spring clip. To install, insert the end which

contacts the edge side of the spring clip and then push down the other end of the battery. Check that the battery is fully inserted and is making good electrical contact with the spring clips.

## 6.8 FUSE REPLACEMENT

**6.8.1** Fuse replacement is indicated when there is no meter deflection on any of the DC, AC VOLTS or OHMS ranges but the 8 A DC range is operating properly.

**6.8.2** Replace with a 1-1/2 amp, 250 volt pigtail fuse, type 3AG or equivalent only. Never use a fuse with a higher current rating. Proceed as follows:

a. Remove the Instrument from its case (refer to paragraph 6.6).

b. Using a small soldering iron (no larger than 60W), unsolder the defective fuse from the printed circuit board.

c. Solder in the replacement fuse and reinstall the Instrument into its case.

## 6.9 CALIBRATION

NOTE: Calibration adjustments must be made only by a qualified technician knowledgeable in the precautions, procedures and equipment required.

**6.9.1** There are seven calibration adjustments, each a trimmer potentiometer. R37 and R38 are used to calibrate the AC voltage ranges; R1 and R35 calibrate the DC current ranges; R39, R40 and R41 calibrate the basic meter circuit (.2V/10 $\mu$A range) and therefore affect all functions and ranges.

**6.9.2** It is recommended that all service except battery and fuse replacement of the printed circuit board be referred to a Simpson Authorized Service Center or to the Simpson Electric Company. If it is necessary to replace components, do not apply heat directly to the printed circuit board. Cut leads close to the body of the component and solder the replacement to the leads.

## 6.10 TEST LEADS

**6.10.1** Each Model 269-3 is furnished with one pair of four-foot test leads. One lead is black and the other red for easy polarity identification. The wire is stranded and extra-flexible. Its insulation is of a special high-grade rubber of superior insulation strength required for the Instrument.

### 6.10.2 TEST LEAD INSPECTION

Inspect the test leads periodically to detect cuts, burns or other damage that could reduce the insulation strength of the leads. When replacement is indicated, ask your local distributor for a new set, Simpson Catalog Number 00115. For maximum safety to the user, do not substitute with test leads that may have inferior insulating properties.

# SECTION VII

# ACCESSORIES, REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

**Table 7-1. Items Furnished With Instrument**

| Quantity | Description | Part Number |
|---|---|---|
| 1 | Test Lead Set: One black and one red insulated lead having probe tips with provision for screw-on alligator clips (one red and one black supplied). | 00115 |
| 1 | Operator's Manual | 5-113016 |
| 1 | 4 kVDC Probe Extension | 00151 |

**Table 7-2. Accessories Available**

| Quantity | Description | Part Number |
|---|---|---|
| 1 | 16 kVDC High Voltage Probe | 00119 |
| | 30 kVDC High Voltage Probe | 00157 |

**Table 7-3. Replacement Parts List**

| Reference Symbol | Description | Part No. |
|---|---|---|
| R1 | 1.6 amp Shunt(calibrated in tester) | 1-110458 |
| R2 | Resistor 1.2Ω (bobbin) | 10-805196 |
| R3 | Resistor 12Ω | 5-112988 |
| R4 | Resistor 120Ω | 5-112987 |
| R5 | Resistor 1.2kΩ | 5-112986 |
| R6 | Resistor 32kΩ | 5-112991 |
| R7 | Resistor 11.2Ω | 5-112990 |
| R8 | Resistor 100.8Ω | 5-112989 |
| R9 | Resistor 1.008kΩ | 5-112993 |
| R10 | Resistor 6.35kΩ | 5-112997 |
| R11 | Resistor 3.73kΩ | 5-110153 |
| R12 | Resistor 63.47kΩ | 1-110152 |
| R13 | Resistor 7.3Ω | 5-112994 |
| R14 | Resistor 89Ω | 1-110155 |

| Reference Symbol | Description | Part No. |
|---|---|---|
| R15 | Resistor 1.69Ω | 5-113000 |
| R16 | Resistor 112.9kΩ | 5-112999 |
| R17 | Resistor 1.17MΩ | 5-112998 |
| R18 | Resistor 140kΩ | 5-113003 |
| R19 | Resistor 640kΩ | 5-113002 |
| R20 | Resistor 3.2MΩ | 5-113001 |
| R21 | Resistor 12MΩ | 5-113006 |
| R22 | Resistor 24MΩ | 5-113005 |
| R23 | Resistor 40MΩ | 5-113004 |
| R24 | Resistor 1.2MΩ | 5-112985 |
| R25 | Resistor 600kΩ | 5-112984 |
| R26 | Resistor 160kΩ | 5-112983 |
| R27 | Resistor 25kΩ | 1-110726 |
| R28 | Resistor 7.5kΩ | 5-110165 |
| R29 | Resistor 2MΩ | 5-113007 |
| R30 | Resistor 80MΩ | 1-117138 |
| R31 | Resistor 5kΩ | 5-110166 |
| R32 | Resistor 5kΩ | 5-110166 |
| R33 | Resistor 45kΩ | 5-110161 |
| R34 | Resistor 27kΩ | 5-112992 |
| R35 | Shunt Assy. 8 ampere (calibrated in tester) | 10-650015 |
| R36 | Potentiometer 50kΩ | 1-110141 |
| R37 | Potentiometer 20kΩ | |
| R38 | Potentiometer 5kΩ | |
| R39 | Potentiometer 10kΩ | 1-110140 |
| R40 | Potentiometer 150kΩ | |
| R41 | Resistor 91kΩ | |
| R42 | Resistor 60kΩ | 5-113293 |
| D1 | Diode 1N87G | 1-115970 |
| D2 | Diode 1N87G | 1-115970 |
| D3 | Diode (Varistor) | 5-110945 |
| C1, C2 | Capacitor .01mfd 50V, ±10% | 5-113184 |
| F1 | Fuse 1-1/2 amp 3AG | 1-110409 |
| | Test Lead Set (one black and one red Lead) | 00115 |
| | High Voltage Multiplier 4000 VDC | 00151 |
| | Molded Phenolic Case | 3-330112 |
| | Adjust-A-Vue Handle Assy. | 3-310812 |
| | Knobs | 1-110170 |
| 7-2 | Meter Assembly | Spec. 13816 |

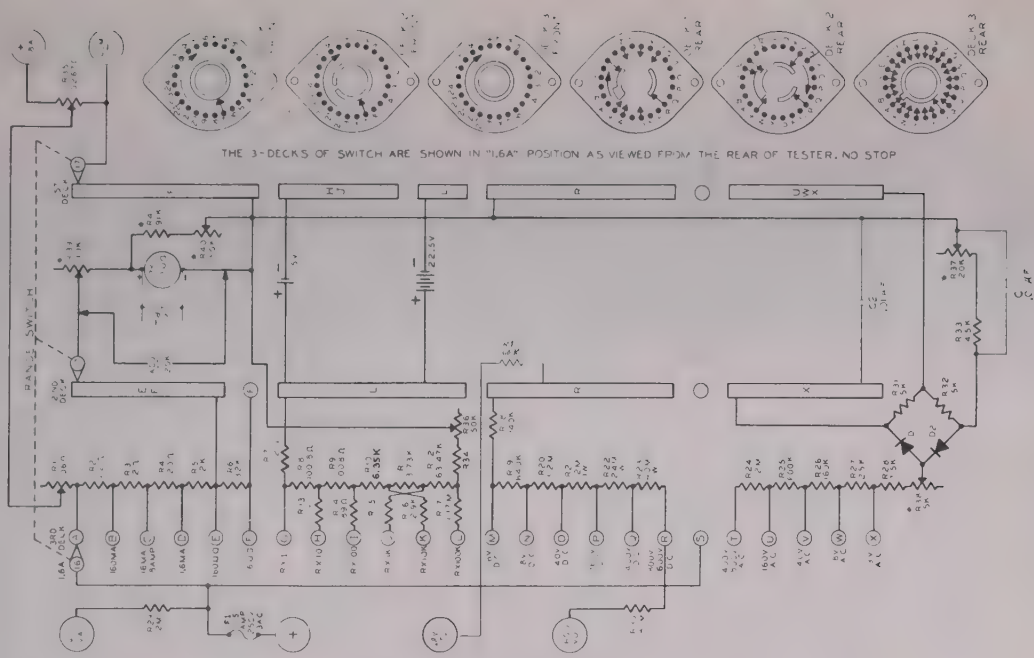
THE 3-DECKS OF SWITCH ARE SHOWN IN "1.6A" POSITION AS VIEWED FROM THE REAR OF TESTER. NO STOP
DECK 1 REAR
DECK 2 REAR
DECK 3 REAR
BAND SWITCH
1.5V
22.5V
NOTES:
1 K=1000 OHMS
2 M=1,000,000 OHMS
△ LAST RESISTOR IS R4
△ LAST DIODE IS D2
△ LAST CAPACITOR IS C
* R37 * R38 * R39 * R40 AND * R41 * PACKAGED AS ONE UNIT
* R37 - WHITE KNOB
* R38 - TAN KNOB
* R39 - BLUE KNOB
* R40 - RED KNOB
* R41 - FIXED RESISTOR

**Figure 7-1. Schematic Diagram**

# AUTHORIZED SERVICE CENTERS

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THE ELECTRO MECHANO COMPANY
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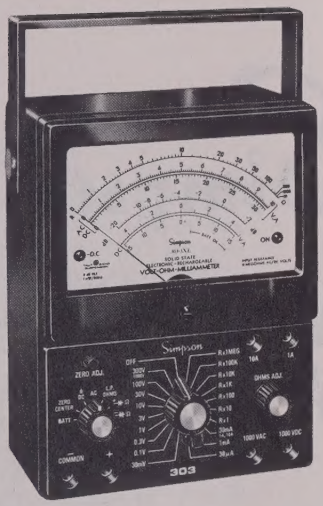
# New Simpson

# 303-3XL

## SOLID-STATE ELECTRONIC RECHARGEABLE VOM




- High impact shock resistant case
- Conventional and Low-Power Ohms selection
- Simplified, easy-reading dial permits making nearly all measurements on the same scale
- Switch-selectable zero center scale for nulling
- Automatic LED "polarity" and "power on" indication
- Single self-contained rechargeable, nickel-cadmium "D" cell provides up to 20 hours of continuous operation; or can be AC line operated
- AC Charger supplied, 120 V or 230 V input, specify.

### SPECIFICATIONS:

**Accuracy:** ±2% F.S. all DC current and voltage ranges, ±3% all AC current ranges and AC voltage ranges up to 100 V, 50 to 400 Hz; 4% 20 Hz to 20 kHz; 10% 2 Hz to 100 kHz AC, F.S.
**Accuracy:** ±2% F.S. at all ranges, DC; 3% 50 to 400 Hz, 4% 20 Hz to 20 kHz, 10% 2 Hz to 100 kHz, AC (F.S.)

**Input Impedance:** 10 Meg Ω DC, 10 Meg Ω AC

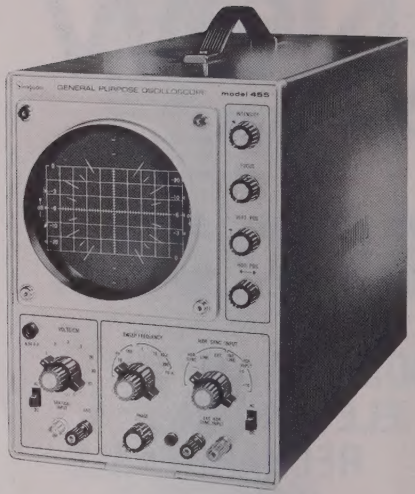
**Frequency Response:** Flat through 20 kHz

**Voltage Ranges:** AC and DC: .03, 0.1, 0.3, 30, 100 and 300. 1000 VAC and 1000 VDC F.S. available through separate jacks
**Current Ranges:** AC and DC: 30μA, 1mA and 30 mA F.S. 1A, 10A available through separate jacks
**Resistance Ranges:** Low-Power ohms and Standard Ohms; Rx1, Rx10, Rx100, Rx1K, Rx10K, Rx100K, Rx1M; 10Ω center scale
**Decibel (dB) Ranges:** −30, −20, −10.0, +10, +20, +30, +40, +50, +60

**ORDER FROM YOUR ELECTRONICS/ELECTRICAL DISTRIBUTOR**

Simpson

# Model 455
# 5" SCOPE




## DC to 10 MHz, 10mV/cm sensitivity 5" CRT

- Direct input for vector display
- 9-step calibrated and compensated vertical attenuator
- Accepts standard scope cameras and viewing hoods
- High linearity sweep with retrace blanking—separate 7875 Hz position for TV work
- 120 or 240 VAC operation, 50 or 60 Hz
- Size: 10 3/8" H x 8" W x 16 1/2" D

**SEE YOUR ELECTRONICS DISTRIBUTOR OR WRITE FOR CATALOG 4300**

# Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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KATY INDUSTRIES
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**IN ENGLAND:** Bach-Simpson (U.K.) Limited, Wadebridge, Cornwall
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